Purpose: Currently, the recommended TomoTherapy patient specific QA involves setting up a DQA procedure and delivering it to a phantom with an ion chamber and film measurement. The process is time-consuming and the DQA result is susceptible to errors in phantom setup. Our study explores the feasibility of using TomoTherapy's intrinsic exit detectors to perform patient specific QA by measuring the fluence received by the detectors during pre-treatment in-air delivery for our STAT-RAD workflow.

Methods: A TomoTherapy patient plan is converted into a calibration procedure in which the couch remains out of the gantry. The signal measured by the exit detector is exported through manufactory provided software. In-house developed software is used to reconstruct exit detector signal from the dicom-exported delivery plan. The software relies on individual leaf profiles as well as tongue-and-groove profiles of each adjacent leaf-pair extracted from an in-house developed calibration procedure. The difference between the reconstructed and measured detector signal can be analyzed by a simple algorithm which has been developed to estimate the dose difference of any given point inside a patient or phantom. Several patient plans have been tested with this in-air delivery QA method. In some of the tested plans, errors have been introduced to assure the estimated point dose error agrees with the ion chamber measurement in a phantom.

Results: The in-house exit detector reconstruction software has been validated to be able to reconstruct the exit detector signal with errors <1%. The software estimated point dose agrees within 3% to the ion chamber measurement.

Conclusions: Our study shows that it is feasible and efficient to perform patient specific QA using the exit detector signal recorded during the in-air pretreatment delivery. This approach is easy to perform and it is faster than conventional QA approach.